# Trash Monitoring Methods in Aquatic Environments: Challenges in Standardization and Answering Management Questions

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# BACKGROUND

Trash has become a management focus throughout the world.

In California we have:

- Bans
- Total Maximum Daily Loads (TMDLs)
- Statewide Trash Policy (Trash Amendments)

# STATEMENT OF PROBLEM

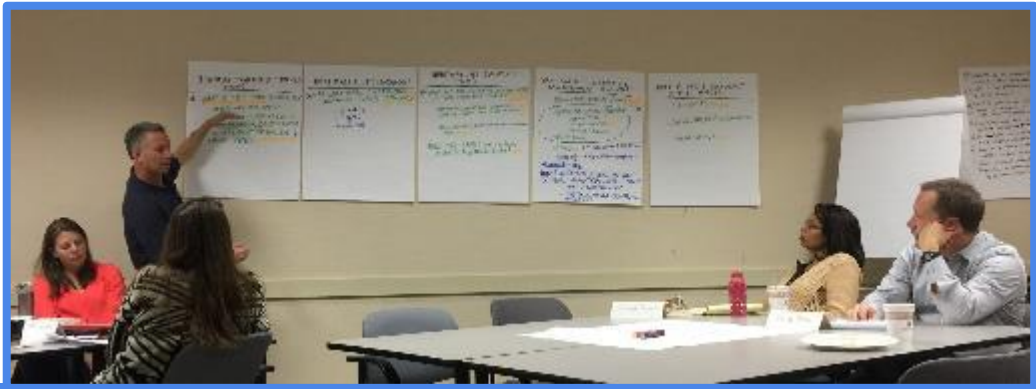
- Wide variety of considerations when monitoring trash
  - What are the management questions?
  - Which habitats are of concern?
  - What monitoring resources are available?
- Methods are developed independently of one another
- We recognize a need to identify/develop standardized monitoring methods to allow for optimum level of comparability spatially and temporally

# STAKEHOLDER CONCEPTUAL MODEL WORKSHOP

- Develop a shared understanding of the key and unresolved issues surrounding trash monitoring

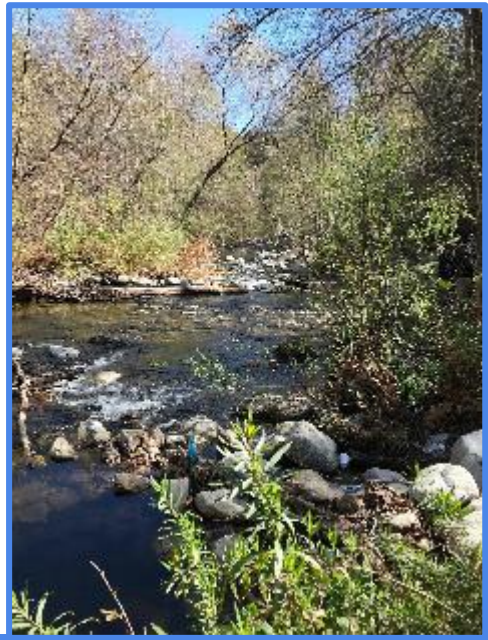
- Develop a list of the main management questions that would guide trash monitoring and examples of the scientific monitoring questions

- Provide recommendations and input regarding trash monitoring methods field testing, validation, and standardization

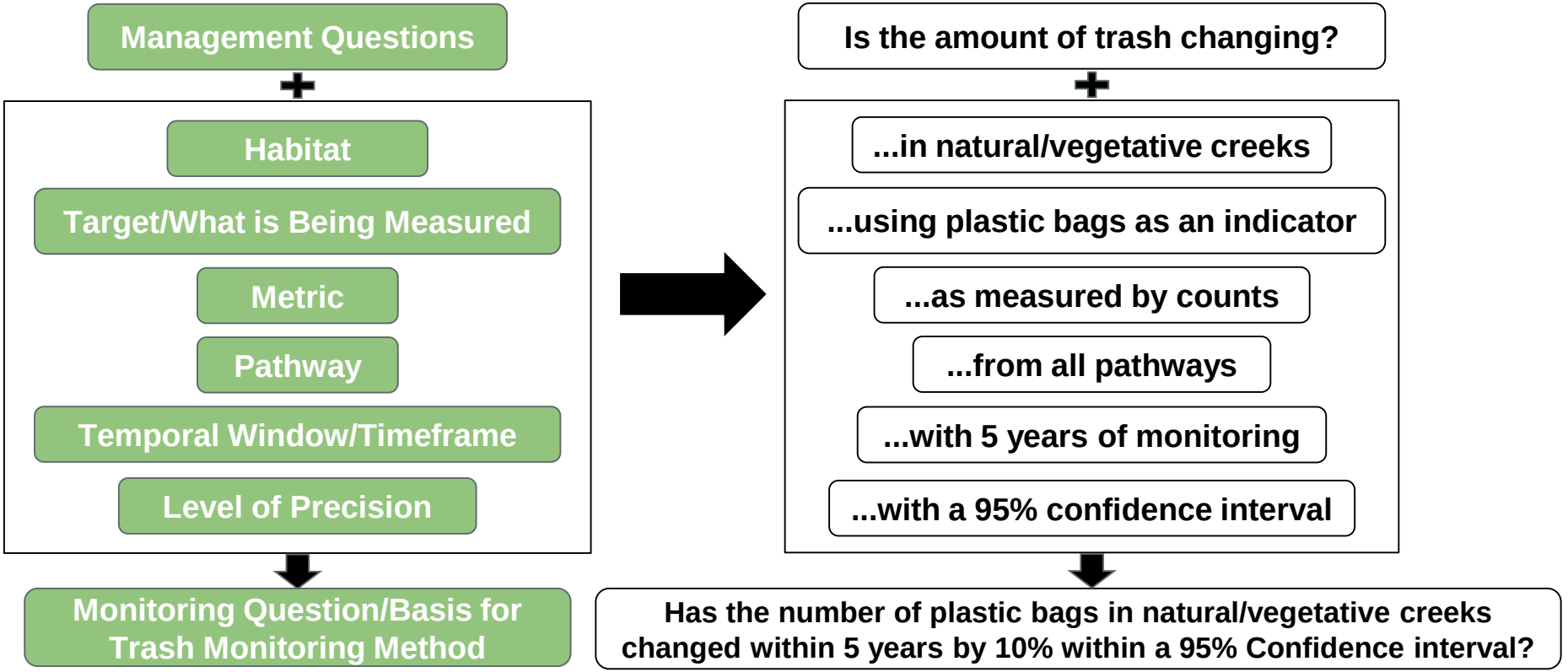


# WHAT CAME OUT OF THE MEETING

- Questions
  - How much trash is out there?
  - At what rate is it changing?
  - What are the sources of trash (how much does the source contribute)?
  - What are the most effective management actions?
  - What is the effect or cost of trash impacts?
- Habitats
  - Primarily interested in receiving waters
  - Applicable throughout California
- Methods of interest
  - Evaluate currently used methods
  - Investigate new innovative methods



# TRANSLATING MANAGEMENT QUESTIONS INTO MONITORING SCIENTIFIC QUESTIONS



# STATEWIDE STANDARDS FOR TRASH MONITORING METHODS PROJECT


- Funder:
  - Ocean Protection Council
- Project Leads:
  - Southern California Coastal Water Research Project (SCCWRP)
  - San Francisco Estuary Institute (SFEI)
- Partner Agency:
  - State Water Resources Control Board

# APPROACH

- Field test four methods
  - Three currently being used by others
  - One novel method
- Bring together a Technical Advisory Committee of experts
- Involve Stakeholders
  - Inform and solicit feedback
  - Participate in field testing

# METHODS

- Qualitative: Rapid Trash Assessment
- Quantitative:
  - Volume: Bay Area Stormwater Management Agencies Association riverine method
  - Counts: Southern California Stormwater Monitoring Coalition riverine tally method
- Novel method
  - UAS: manual and machine learning-based identification of trash

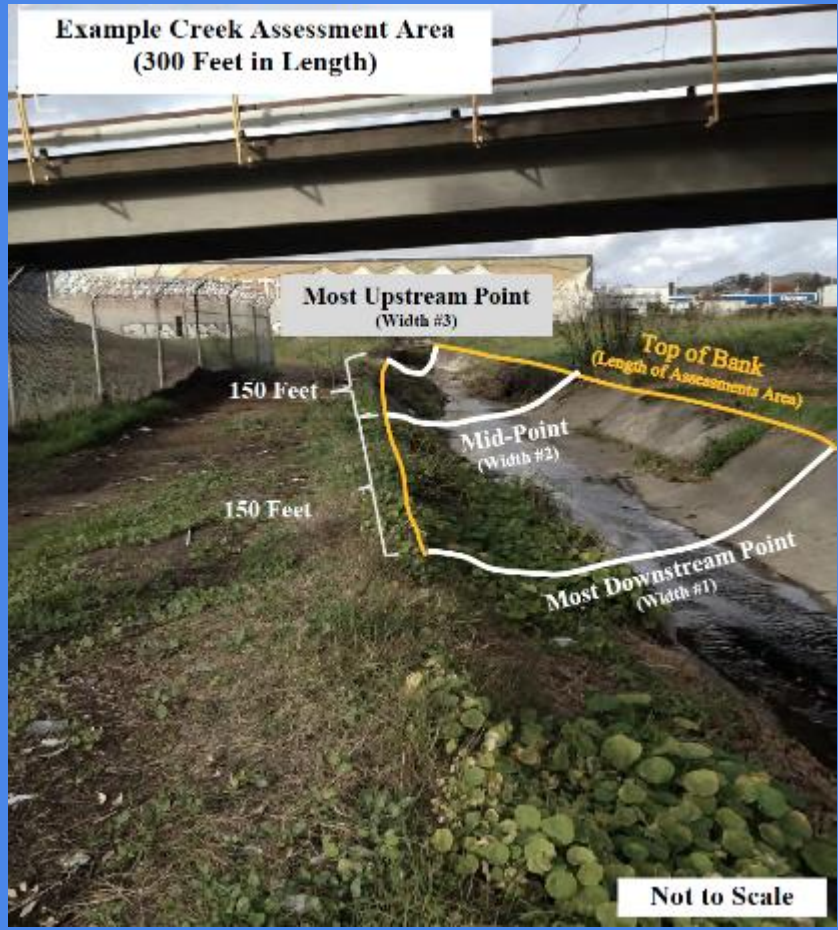



Photo taken from the BASMAA Receiving Water Trash Monitoring Program Plan for the San Francisco Bay Region.

# PRODUCTS


- Playbook for Trash Monitoring
  - Standard Operating Procedures for each method
  - Includes information to help stakeholders choose their method
  - Recommends data management and analysis standards to allow for comparability
  - Usable by a variety of stakeholders
- Outreach and Training
  - Modules with instruction on each method
  - Meetings with a variety of stakeholders to share project information

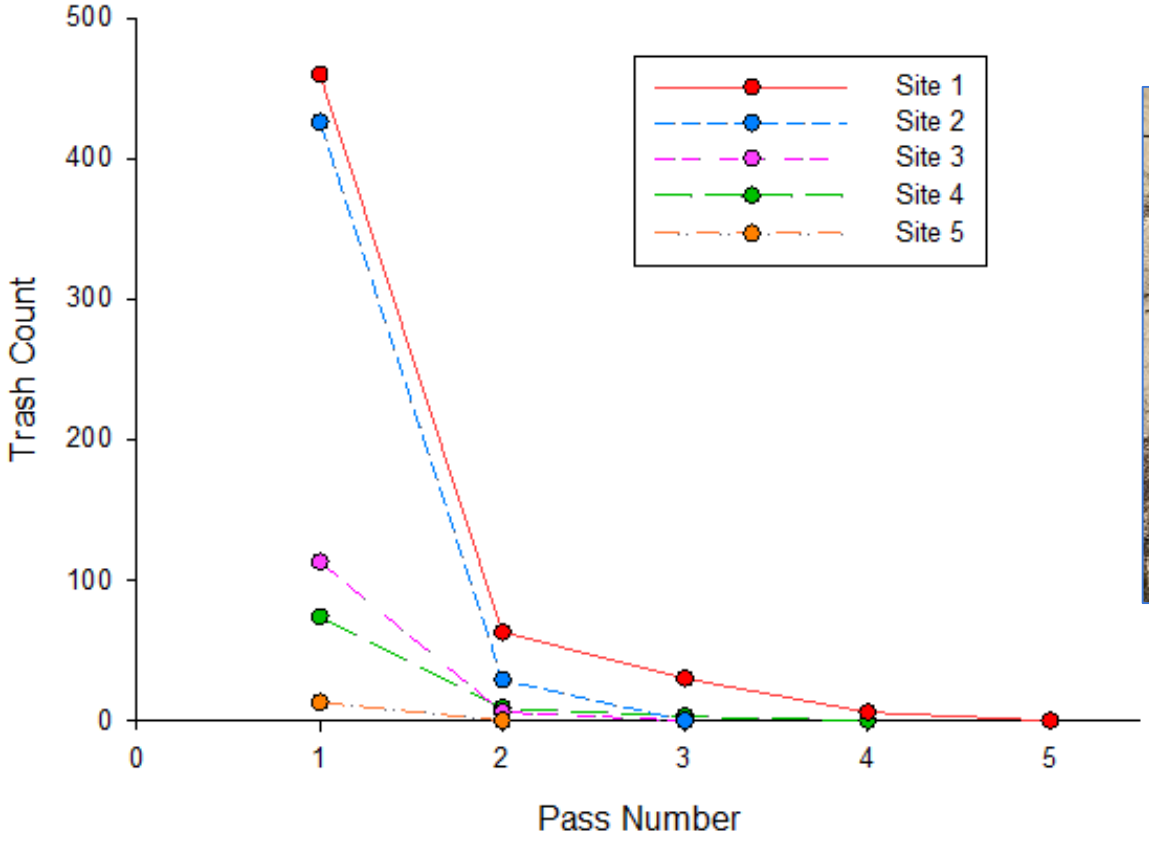
# COMPARISON TABLE / MATRIX

| METHOD | MONITORING QUESTIONS | BIAS | REPEATABILITY | RESOURCES |
|---|---|---|---|---|
| A | | | | $$$$$ |
| B | | | | $$$ |
| C | | | | $$ |
| D | | | | $ |

# CURRENT STATUS

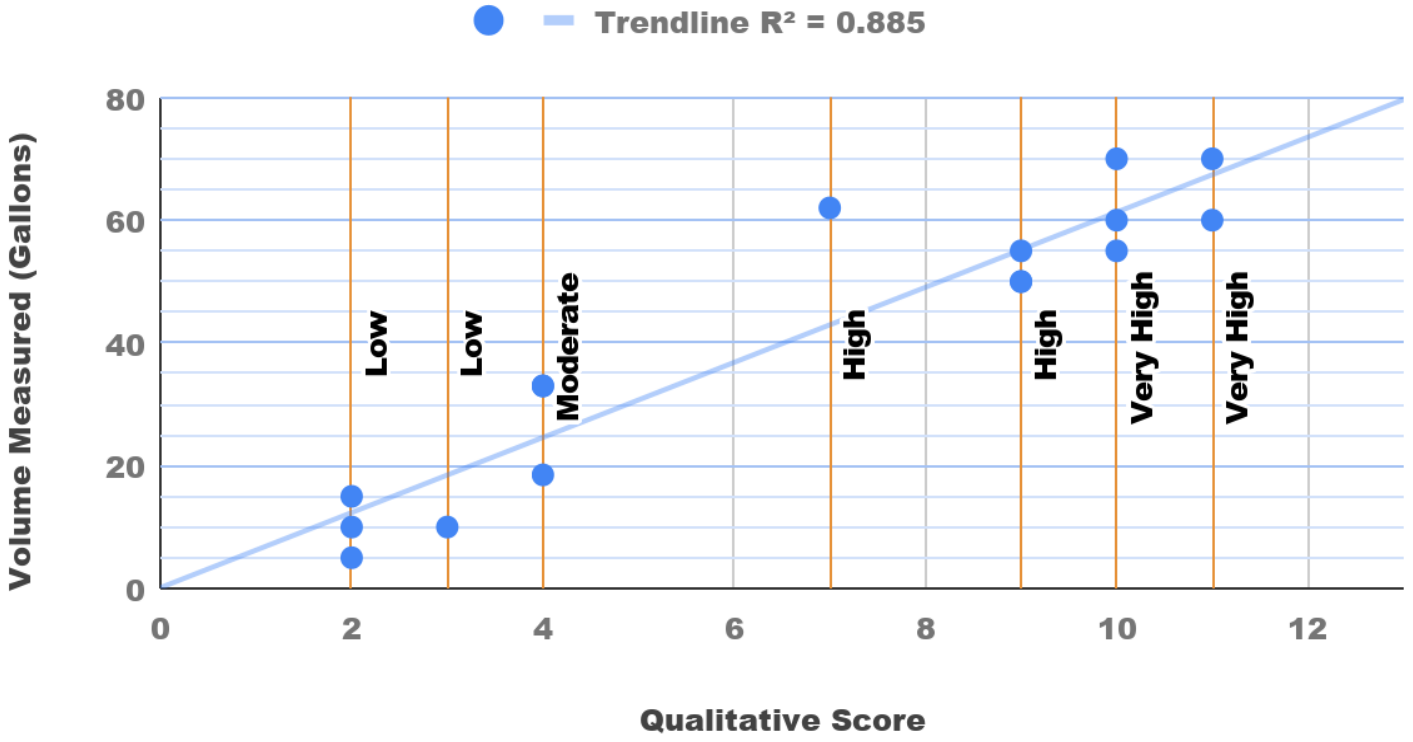
- Trash Assessments
  - Finished first field testing season
- Novel method development
  - Assembled an image library
  - Begun annotation work
  - Begun algorithm development
- Communication
  - Project outreach via meetings, website development, and newsletters

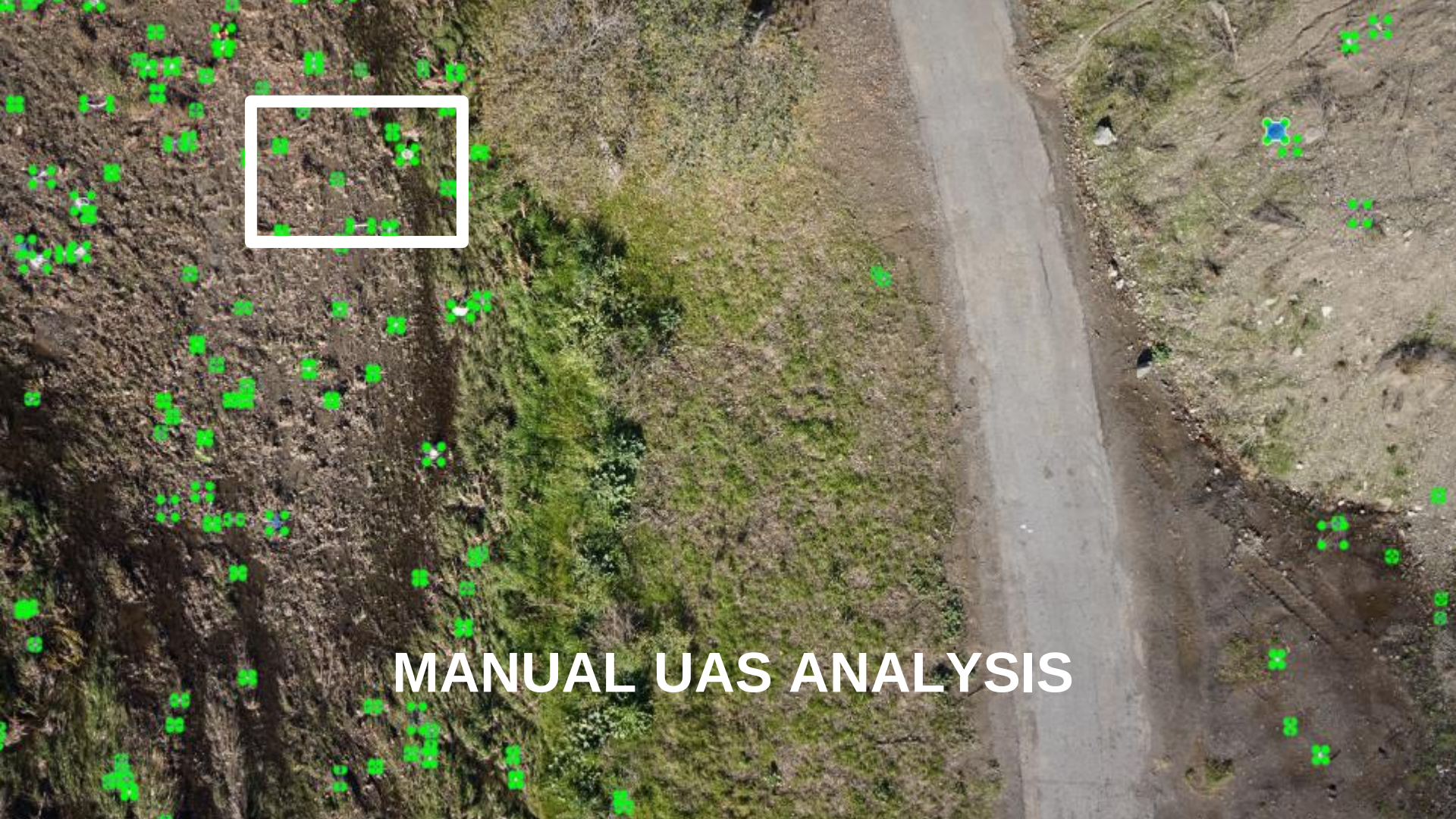
# TALLY METHOD EXTINCTION CURVES



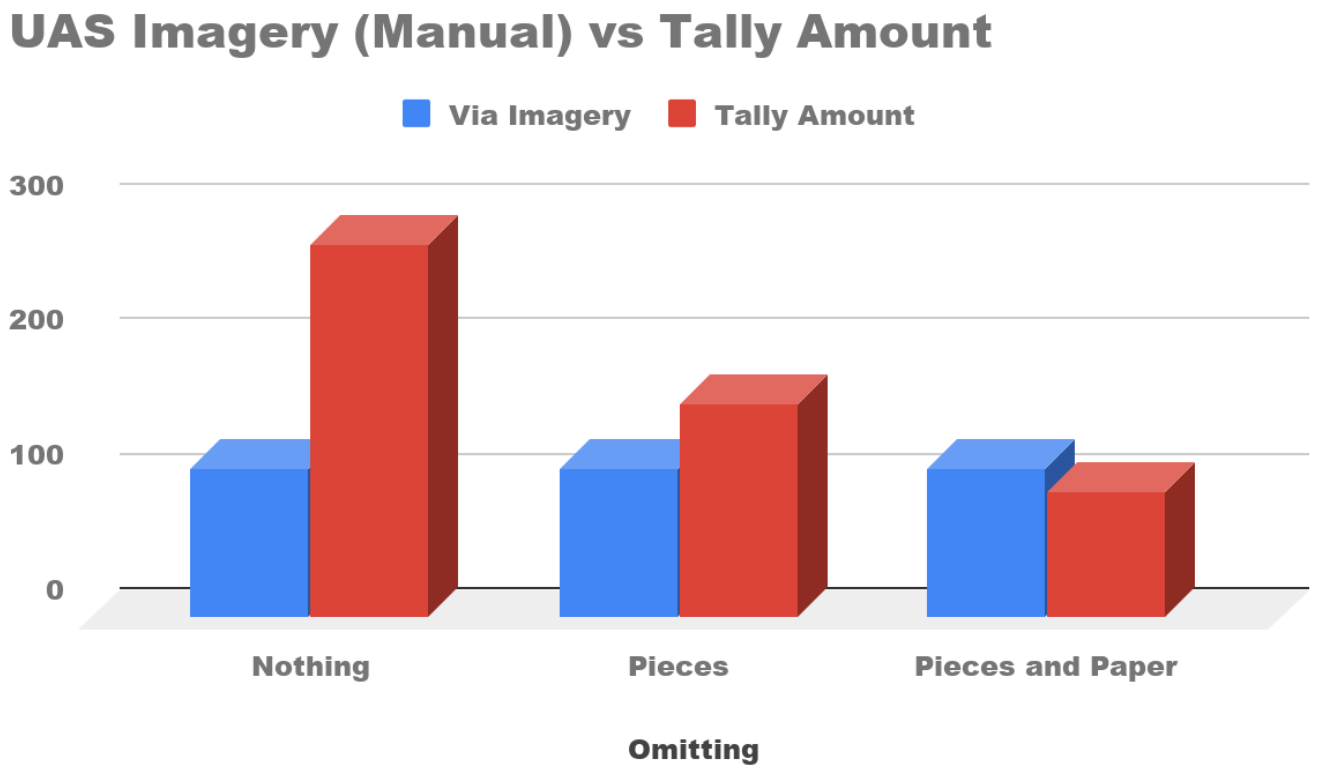

Site 1

# VOLUME VS QUALITATIVE




MANUAL UAS ANALYSIS

# COMPARISON OF UAS VS TALLY



# WHAT IS NEXT?

- Second season of Field Testing to begin this summer
  - Adjustments made to methods
  - Further testing of bias and repeatability
- Aerial image analysis to continue
  - Annotation
    - Plastic
    - Non-Plastic
    - Unknown
  - Training of the Convolutional Neural Network (CNN)
  - Detection of Trash using the developed CNN
- Continued outreach to stakeholders

# TO FIND OUT MORE:

- Visit trashmonitoring.org
- Sign up for our newsletter through the website for updates
- Contact:
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  - Tony Hale, SFEI
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